REMARK

Applicant has carefully reviewed the Examiner's Office Action dated May 14, 2002, in which the Examiner rejected claims 1, 2, 9, and 12 under 35 U.S.C. 102(b) as being anticipated by Anderson(US 5,790,750) and claims 3-8, 10, and 11 under 35 U.S.C. 103(a) as being unpatentable over Anderson as applied to claim 1 and further in view of Halpin, et al (US 6,113,702). And also, claims 13 and 14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite in that it fails to point out what is included or excluded by the claim language.

AMENDMENT OF THE CLAIMS

Claim 13 has been cancelled, claims 8, 10 and 14 have been amended and claims 15 to 21 have been newly added to make the claimed subject matter more clearly distinguishable over the cited references. It is believed that the newly added claims 15 to 21 are fully supported in the original specification.

Attached hereto is a marked-up version of the change made to the claims by the current amendment. The attached page is captioned **VERSION WITH MARKINGS TO SHOW CHANGES MADE**.

In view of the amendments made above and for the reasons states below, it is respectfully submitted that the pending claims 1-12, 14-21 are now in condition for allowance; and, therefore, the Examiner's early allowance thereof is respectfully requested.

REJECTION UNDER 35 U.S.C. 102(b)

The Examiner rejected claims 1, 2, 9 and 12 under U.S.C 102 (b).

By way of review, the present invention as defined in claims 1 and 12 are directed to a method for controlling temperatures in a semiconductor manufacturing apparatus having a plurality of heating sources by way of determining a set of power ratios to be fed to the heating sources for each of two or more selected temperatures and controlling a given temperature based on the predetermined power ratios. By adaptively controlling varying temperatures based on the predetermined power ratios of the heating sources for selected temperatures, power control can be efficiently carried out to achieve a predetermined processing temperature profile.

However, in Anderson, temperature controlling is achieved by using a temperature set point and power ratios thereof, which are empirically derived by production recipe producing optimal results and entered by the operator or

overall control program(column 8, lines 57-67 and column 9, line 1-4). Anderson is completely silent on the fact that a set of power ratios for two or more selected temperatures are predetermined and that the power ratios for a given temperature is determined based on predetermined power ratios for selected temperatures as defined claims 1 and 12 of the present invention.

Claims 1 and 12, in general, and the determining steps and the controlling step thereof, in particular, are not disclosed in Anderson and, therefore, it is respectfully submitted that claims 1 and 12 define a patentable invention over the prior art, including Anderson, and is, therefore, allowable.

Claim 2 defines the selected temperatures to be used for determining power ratios for any desired temperatures and claim 9 specifies that, based on the predetermined power ratios, power ratios for the given temperature are determined by using the target temperature as a reference. None of these features are not disclosed, taught or implied in the cited references including Anderson.

Therefore, it is also believed that claims 2 and 9 directly depending on claim 1 are allowable for the same reasons indicated with respect to the claim 1 and further because of the additional features recited therein which, when taken alone and/or in combination with the features recited in the claim 1 remove the invention defined therein further from the disclosures made in the cited references

including Anderson.

REJECTION UNDER 35 U.S.C. 103(a)

The Examiner rejected claims 3-8, 10 and 11 under U.S.C 103 (a).

Claim 3 specifies that the power ratios of the given temperature are determined based on power ratios for one or two selected temperatures closet to the given temperature.

Claim 4 specifies that the power ratios of the given temperature be determined by interpolating the power ratios of the two selected temperatures.

Claim 5 specifies that power control is carried out by using P, I, and D operation outputs and the power ratios of the given temperature determined through the use of predetermined power ratios of the selected temperatures.

Claims 6-8 define the specific ways of obtaining power output for a heating source by using different weight factors for different situations.

Claim 10 specifies that at least one set of power ratios to be used in determining power ratios for the given temperature be determined by using a target or a measured temperature depending on processing stages of the reaction chamber.

Claim 11 specifies that temperature detection devices are installed near a center of a wafer and close to a

peripheral portion thereof.

Halpin discloses that the power ratios may be set according to the needs for the process(column 20, lines 53-67 and column 21, lines 1-56) and the method for maintaining the temperature between the wafer and the susceptor approximately the same during heating cycle, cooling cycle or steady state(column 21, lines 8-10), but there is no disclosure and suggestion that a set of power ratios for each of the plurality of temperatures can be predetermined respectively. As the object of Halpin is to control temperature to be uniform between susceptor and wafer mounted thereon, power ratios control occurs to be changed only between upper and lower heating banks corresponding to specific zone and also power ratios stay uniformly for varying temperature and in turn, power ratios vary during steady state of temperature, as shown in Fig. 20 of Halpin(column 21, lines 28-56).

None of the specified inventive features in claims 3-8, 10 and 11 are disclosed, taught or implied in none of the cited references including Anderson and Halpin.

Further, it is respectfully submitted that Examiner's hindsight combination of Anderson and Halpin is believed entirely improper in the absence of any suggestion, teaching or motivation given in any of the prior art reference to do so, and inasmuch as one skilled in the art

would have no reason to make such combination.

Furthermore, even assuming, arguendo, that such combination were proper, such combination still cannot render the present invention obvious because neither Anderson nor Halpin discloses or even implies the present invention. Accordingly, even if every single disclosure contained in each of the references is selectively chosen and stacked together against the present invention, such combination cannot possibly suggest to an ordinary person skilled in the art the inventive features of the present invention.

As stated above, the prior art references do not show, independently or in combination, the inventive features of the present invention as set forth in claims 3-8, 10 and 11. Accordingly, it is respectfully submitted that claims 3-8, 10 and 11 defines a patentable invention over the prior art references, including Anderson and Halpin.

REJECTION UNDER 35 U.S.C. 112

The examiner rejected claims 13 and 14 under 35 U.S.C. 112, second paragraph, as being indefinite in that claims 13 and 14 do not recite structural limitations which point out applicant's invention.

With respect to the 112 rejection, claim 13 has been cancelled and claim 14 has been amended as set forth above to recite structural limitations which point out applicant's invention.

The amended claim 14 includes (1) at least one temperature sensor provided at each of central and peripheral region of the reaction chamber and (2) a control unit for controlling power sources of central and peripheral zones based on measured temperatures obtained from corresponding temperature sensors. These features are not disclosed, taught or even implied in the prior art references including Anderson and Halpin.

Accordingly, it is believed that the above amendments made to the claims have removed the reason for the 112 rejection.

NEWLY ADDED CLAIMS

Claims 15-21 have been newly added.

Claims 15 and 21 specify that the given temperature differs from the selected temperatures.

Claim 16 specifies that the heating sources are independently controlled.

Claims 17 and 18 specify that temperature control for

a central or peripheral region is carried out by using a measured temperature obtained from a corresponding region.

Claim 19 specifies that temperature sensors are provided at the central and peripheral region below a susceptor level. Such feature enables to prevent contamination from the temperature sensor to a wafer being processed.

Claim 20 has identical limitations as in claim 1.

None of these features defined in the added claims 15-21 are not disclosed, taught or even implied in the prior art references including Anderson and Halpin.

Especially, claims 15 and 21 specifies that the given temperature differs from the selected temperatures and a set of power ratios for the given temperature to be controlled is determined by difference between the given temperatures and selected temperatures and the predetermined set of power ratios for the selected temperatures.

Therefore, it is believed that newly added claims 15-21 define a patentable invention over the prior art references, including Anderson and Halpin.

CONCLUSION

Applicant believes that this is a full and complete response to the Office Action. For the reasons discussed above, applicant now respectfully submits that all of the pending claims are in complete condition for allowance. Accordingly, it is requested that claim 1-12 and 14-21 be allowed in their present form. If the Examiner feels that any issues that remain require discussion, he is kindly invited to contact applicant's undersigned attorney to resolve the issues.

Respectfully Submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claim 13 has been cancelled.

Claims 8, 10 and 14 have been amended as follows:

8. (Amended) The method of claim 5, wherein a controlled power output for a heating source is determined by multiplying the P, the D and the I operation outputs by a power ratio during processing a wafer and is determined by multiplying the power ratio only by the I operation output when [there exists an external disturbance in the reaction chamber caused by loading a wafer thereinto] loading a wafer into the reaction chamber.

10. (Amended) The method of claim 1, wherein said at least one set of power ratios is selected by using a target temperature when [there exists an external disturbance in the reaction chamber caused by loading a wafer thereinto] loading a wafer into the reaction chamber and is selected by using a measured temperature during processing a wafer.

14. (Amended) An apparatus for manufacturing a semiconductor device by using the method of claim 1, comprising:

a reaction chamber;

a rotatable susceptor, provided in the reaction chamber, for mounting a wafer thereon, wherein the reaction chamber includes a central region disposed around a rotational axis of the susceptor and a peripheral region formed along a circumferential region of the wafer;

a plurality of heating sources for heating the wafer, wherein the heating sources are divided into at least a central zone corresponding to the central region and a peripheral zone corresponding to the peripheral region, each zone having plural heating sources;

at least one temperature sensor provided at each of the central region and the peripheral region of the reaction chamber; and

a control unit for controlling a power ratio for each heating source in each zone based on an output of the temperature sensor corresponding to said each zone.

Claims 15-21 have been added as follows:

15. (New) The method of claim 1, wherein the given temperature differs from the selected temperatures.

16. (New) The method of claim 1, wherein power for each of the plurality of heating sources is independently controlled.

17. (New) The method of claim 1, wherein the heating sources are divided into a central zone corresponding to a

central region of the reaction chamber and a peripheral zone corresponding to a peripheral region of the reaction chamber and

wherein powers to heating sources in the central zone are controlled by using a measured temperature from a temperature sensor provided at the central region of the reaction chamber and powers to heating sources in the peripheral zone are controlled by using a measured temperature from a temperature sensor provided at the peripheral region of the reaction chamber.

18. (New) An apparatus for manufacturing a semiconductor device, comprising:

a reaction chamber;

a rotatable susceptor, provided in the reaction chamber, for mounting a wafer thereon, wherein the reaction chamber includes a central region disposed around a rotational axis of the susceptor and a peripheral region formed along a circumferential region of the wafer;

a plurality of heating sources for heating the wafer, wherein the heating sources are divided into at least a central zone corresponding to the central region and a peripheral zone corresponding to the peripheral region, each zone having plural heating sources;

at least one temperature sensor provided at each of the central region and the peripheral region of the reaction chamber; and

a control unit for controlling a power ratio for each

heating source in each zone based on an output of the temperature sensor corresponding to said each zone.

19. (New) The apparatus of claim 18, wherein the temperature sensors provided at the central and the peripheral region are located below a susceptor level.

20. (New) A method for controlling temperatures in a semiconductor manufacturing apparatus comprising the apparatus of claim 18, including the steps of:

determining a set of power ratio to be fed to the heating sources for each of two or more selected temperatures; and

controlling a given temperature by performing power control on the heating sources based on at least one set of power ratios obtained in the determining step.

21. (New) The method of claim 20, wherein the given temperature differs from the selected temperatures.